 221205/221406/2243CN

LA TROBE UNIVERSITY, BENDIGO

Final Examination, July 1996

221205 Computing 205: Computer Networks
221406 Computing 406: Network Architecture
2243CN IT8: Computer Communications

Examiner: P. Scott

Time Allowed: Three (3) Hours

Instructions to Candidates:

1. This paper consists of ***six*** (6) questions.
2. All questions should be attempted.
3. All questions have equal marks.
4. Marks for this paper total 120.
5. Sixty percent (60%) of the final assessment for this subject will be based on this paper.
6. No reference material may be used.
7 Non–programmable calculators may be used.
8. Any assumptions made in answering questions should be stated.

Question 1

(a) What is your preferred ***electronic mail address*** at La Trobe University, Bendigo?

(b) The Transmission Control Protocol (***TCP***) is the most common protocol used to provide transport layer service in the Internet. What are the characteristics of the service supplied to an application process by TCP?

(c) The TCP protocol is normally used in the context of a ***client-server*** model of communication. Describe briefly what is meant by this term. In particular, what characterises a server process, and how does a client process use the facilities provided by a server?

(d) What is ***remote login***, and what is the standard protocol which provides remote login on the Internet?

(e) Describe briefly the structure of a basic (RFC822) ***electronic mail message***, and explain how the SMTP (RFC821) protocol is used to deliver such a message to an Internet-connected computer. Note that you are not expected to remember all of the details of an SMTP transaction, just the basic ideas involved.

(2 + 4 + 6 + 2 + 6) = 20 Marks)

Question 2

(a) What are the three main characteristics of ***IP*** (Internet Protocol) datagram delivery in the Internet?

(b) The dotted sequence **`203.8.14.225`** is an Internet Protocol (IP) address for a certain computer which is connected to the Internet. For this computer, give the ***class*** of the IP network to which it is connected and state the network and host parts of the address. Note that subnetting is not used.

(c) The ***Domain Name System*** used in the Internet provides a convenient and flexible way to refer to a computer by name, instead of by its IP address.

(i) What is the structure (or format) of an Internet Domain Name?

(ii) What does it mean to "look up" an IP address?

(d) The following give the output of two runs of the ***traceroute*** command, the first on the redgum system at Bendigo, and the second on a machine outside La Trobe University tracing the route back to redgum. Traceroute is used to discover the route a datagram would take in the Internet[1].

```
 1  r-busbgo (149.144.21.254)  1 ms  1 ms  1 ms
 2  itsfddi0 (149.144.10.254)  1 ms  1 ms  2 ms
 3  r-bgowan (149.144.2.1)  4 ms  3 ms  2 ms
 4  149.144.1.1 (149.144.1.1)  31 ms  28 ms  28 ms
 5  131.172.20.12 (131.172.20.12)  30 ms  51 ms  84 ms

13  general-r-fddi.latrobe.edu.au (131.172.20.1) 466 ms 413 ms
14  149.144.1.2 (149.144.1.2)  340 ms  293 ms  435 ms
15  r-itsbgo.bendigo.latrobe.edu.au (149.144.2.254)  282 ms
16  busfddi0.bendigo.latrobe.edu.au (149.144.10.1)  529 ms
17  redgum.bendigo.latrobe.edu.au (149.144.21.3)  167 ms  97 ms
```

(i) Why are the names and/or IP addresses different in each of the traceroute outputs, even though the same routers are involved?

(ii) Draw a labelled diagram of the structure of the Internet in the region described by these traceroute outputs.

(3 + 3 + (3 + 3) + (4 + 4)) = 20 Marks)

[1] Note that the time fields of some entries have been edited to fit on the line. Note also that the first 12 entries of the second run have been deleted for clarity.

Question 3

(a) How can the ordinary telephone system (or PSTN) be utilised for data communications, and under what circumstances is this commonly done nowadays?

(b) Briefly describe the operation of the ***CSMA/CD*** MAC sublayer protocol which is used in Ethernet and 802.3 LANs.

(c) The point-to-point data link between the Bendigo campus of La Trobe University, and the campus at Bundoora operates at 252 kbps. Why such an unusual bit rate? Explain briefly.

(d) An ISDN data call between Bendigo and Melbourne (rate: Telstra NDD3) costs (day rate) 14.0¢ flagfall and 0.50006¢ per second. This can be compared with the (Telstra) PSTN day rate over the same distance of approximately 35¢ per minute. Calculate the cost to transfer 1 Mbyte of data between Bendigo and Melbourne using each of these services. Assume that all of the necessary phone services and other equipment are already connected and paid for, and make reasonable assumptions about the performance of current technology modems. Ignore protocol and other overheads in your calculations.

(e) Explain how a ***frame relay*** service operating at a port speed of 64 kbps differs from an ISDN semi permanent link at the same speed. In particular, why would you expect the frame relay service to be cheaper?

(4 + 4 + 4 + 4 + 4 = 20 Marks)

Question 4

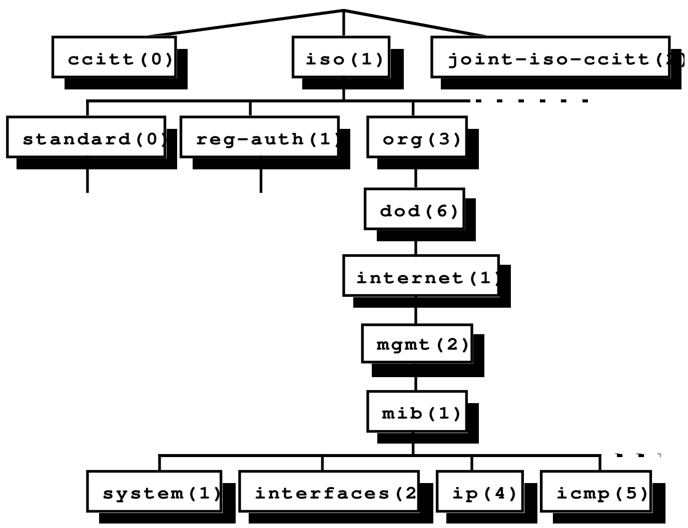
(a) What information can the network manager obtain from the ***ping*** command? Give at least two examples.

(b) The ***ASN.1*** specification language is an integral part of the OSI Reference Model upper layer architecture, and is used in some protocols in the Internet.

(i) What is meant by the term ***abstract syntax***, as implemented in ASN.1?

(ii) What is the general format of an ASN.1 data structure which has been encoded for transmission using the ASN.1 ***Basic Encoding Rules*** (BER)?

(c) The following diagram is used to describe the Management Information Base (MIB) of the Simple Network Management Protocol, SNMP.



(i) What is the numerical **OBJECT IDENTIFIER** of the MIB variable

ipForwDatagrams OBJECT-TYPE ::= { ip 6 }

(ii) How would you refer to this variable if you were interested to obtain its *actual value* using an SNMP ***get*** request?

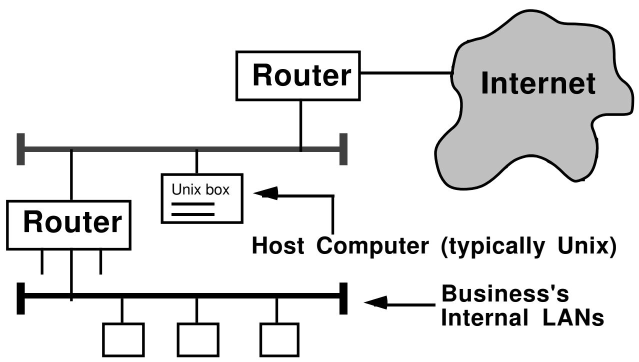
(d) What is the function of the ***get-next*** request in SNMP, and why is it regarded as particularly powerful?

(4 + (3 + 3) + (2 + 4) + 4 = 20 Marks)

Question 5

(a) Describe briefly two kinds of ***security attacks*** which can be directed against an Internet-connected computer system.

(b) The following diagram shows a structure used by many businesses when they connect to the Internet in a secure way:



Explain how the Unix host and each of the routers in this structure would be configured to safeguard computers connected to the business's internal LANs against attack originating from the external Internet.

(c) The following string of bits is ciphertext which has been encrypted using a ***Vernam cipher***. The key which must be used for decryption is also shown. Use your cryptographic knowledge to crack the code and discover the plaintext message. Some (possibly useful) ASCII codes are given below to convert the resulting plaintext bit string into English text.

Ciphertext: `0001010 0001001 0000010`

Key: `1001011 1000101 1000111`

Some ASCII character codes:

A: `1000001`	B: `1000010`	C: `1000011`	D: `1000100`	E: `1000101`
F: `1000110`	G: `1000111`	H: `1001000`	I: `1001001`	J: `1001010`
K: `1001011`	L: `1001100`	M: `1001101`	N: `1001110`	O: `1001111`

(d) What is one advantage of each of ***single key*** and ***public key*** encryption.

(4 + 8 + 4 + 4 = 20 Marks)

Question 6

(a) What is ***Electronic Data Interchange*** (EDI)? How is it different to an electronic mail service?

(b) What is the significance of the ***X.12*** and ***EDIFACT*** standards for EDI?

(c) What distinguishes ***client/server computing*** from any other form of distributed data processing, and what is meant by the term ***middleware*** in this context?

(d) The ***World Wide Web*** (WWW) is said to be a very good example of a client/server system. A spinoff from this technology is the potential for the use of WWW browsers as "universal clients". What is meant by this?

(e) What is a ***CGI*** program in the context of the WWW, and what does a CGI program generate as output to a browser?

(4 + 4 + 4 + 4 + 4 = 20 Marks)